

THAT WHICH IS CLAIMED:

1. (Currently Amended) A composition comprising:
 - (a) manganese oxide; and
 - (b) a promoter

wherein said composition has been reduced with a suitable reducing agent under suitable conditions so that at least a portion of said promoter is present as a zero valence promoter, and wherein said promoter is present in an amount which will effect the removal of sulfur from a hydrocarbon stream when contacted with said composition under desulfurization conditions.

2. (Canceled)

3. (Original) A composition in accordance with claim 1 wherein said promoter comprises a metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, and combinations of any two or more thereof.

4. (Original) A composition in accordance with claim 1 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

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5. (Original) A composition in accordance with claim 1 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

6. (Original) A composition in accordance with claim 1 wherein said manganese oxide is present in an amount in the range of from 50 to 70 weight percent.

7. (Original) A composition in accordance with claim 1 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

8. (Original) A composition in accordance with claim 1 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

9. (Original) A composition in accordance with claim 1 wherein said promoter is present in an amount in the range of from 8 to 20 weight percent.

10. (Original) A composition in accordance with claim 1 wherein said promoter comprises nickel.

11. (Original) A composition in accordance with claim 1 wherein said promoter comprises cobalt.

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12. (Original) A composition in accordance with claim 1 wherein said promoter comprises a solid solution of nickel and zinc.

13. (Original) A composition in accordance with claim 1 wherein said composition is a particulate in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres.

14. (Original) A composition in accordance with claim 13 wherein said particulate is a microsphere.

15. (Currently Amended) A composition comprising:

- (a) manganese oxide;
- (b) a silicon-containing material;
- (c) an aluminum-containing material selected from the group consisting of alumina, aluminate, and combinations thereof; and
- (d) a promoter

wherein said composition has been reduced with a suitable reducing agent under suitable conditions so that at least a portion of said promoter is present as a zero valence promoter, and wherein said promoter is present in an amount which will effect the removal of sulfur from a hydrocarbon stream when contacted with said composition under desulfurization conditions.

16. (Canceled)

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17. (Original) A composition in accordance with claim 15 wherein said promoter comprises a metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, and combinations of any two or more thereof.

18. (Original) A composition in accordance with claim 15 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

19. (Original) A composition in accordance with claim 15 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

20. (Original) A composition in accordance with claim 15 wherein said manganese oxide is present in an amount in the range of from 50 to 70 weight percent.

21. (Original) A composition in accordance with claim 15 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

22. (Original) A composition in accordance with claim 15 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

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23. (Original) A composition in accordance with claim 15 wherein said promoter is present in an amount in the range of from 8 to 20 weight percent.

24. (Original) A composition in accordance with claim 15 wherein said silicon-containing material is present in an amount in the range of from about 10 to about 40 weight percent and said aluminum-containing material is present in an amount in the range of from about 1 to about 30 weight percent.

25. (Original) A composition in accordance with claim 15 wherein said silicon-containing material is present in an amount in the range of from about 12 to about 30 weight percent and said aluminum-containing material is present in an amount in the range of from about 5 to about 25 weight percent.

26. (Original) A composition in accordance with claim 15 wherein said silicon-containing material is present in an amount in the range of from 13 to 20 weight percent and said aluminum-containing material is present in an amount in the range of from 10 to 20 weight percent.

27. (Original) A composition in accordance with claim 15 wherein said promoter comprises nickel.

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28. (Original) A composition in accordance with claim 15 wherein said promoter comprises cobalt.

29. (Original) A composition in accordance with claim 15 wherein said promoter comprises a solid solution of nickel and zinc.

30. (Original) A composition in accordance with claim 15 wherein said silicon-containing material is present in the form of expanded perlite.

31. (Original) A composition in accordance with claim 30 wherein said expanded perlite is milled.

32. (Original) A composition in accordance with claim 15 wherein said composition is a particulate in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres.

33. (Original) A composition in accordance with claim 32 wherein said particulate is a microsphere.

34. (Withdrawn) A process for the production of a composition comprising:

(a) admixing: 1) a liquid, 2) manganese oxide, 3) a silicon-containing material, 4) alumina, and 5) a promoter so as to form a mixture thereof;

(b) drying said mixture so as to form a dried mixture;

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(c) calcining said dried mixture so as to form a calcined mixture;

(d) reducing said calcined mixture with a suitable reducing agent under suitable conditions to produce a composition having a reduced valence promoter content therein, and

(e) recovering said composition.

35. (Withdrawn) A process in accordance with claim 34 wherein said calcined mixture is reduced in step (d) such that said composition will effect the removal of sulfur from a stream of hydrocarbons when such stream is contacted with same under desulfurization conditions.

36. (Withdrawn) A process in accordance with claim 34 wherein said promoter comprises a metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, and combinations of any two or more thereof.

37. (Withdrawn) A process in accordance with claim 34 wherein said silicon-containing material is in the form of expanded perlite.

38. (Withdrawn) A process in accordance with claim 34 wherein said mixture from step (a) is in the form of one of a wet mix, dough, paste, or slurry.

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39. (Withdrawn) A process in accordance with claim 34 wherein said mixture from step (a) is particulated prior to said drying in step (b).

40. (Withdrawn) A process in accordance with claim 34 wherein said mixture from step (a) is particulated in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres prior to said drying in step (b).

41. (Withdrawn) A process in accordance with claim 34 wherein said mixture from step (a) is particulated by spray drying in step (b) so as to form said dried mixture.

42. (Withdrawn) A process in accordance with claim 34 wherein said mixture is dried in step (b) at a temperature in the range of from about 150°F to about 450°F.

43. (Withdrawn) A process in accordance with claim 34 wherein said dried mixture is calcined in step (c) at a temperature in the range of from about 400 to about 1500°F.

44. (Withdrawn) A process in accordance with claim 34 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

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45. (Withdrawn) A process in accordance with claim 34 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

46. (Withdrawn) A process in accordance with claim 34 wherein said manganese oxide is present in an amount in the range of from 50 to 70 weight percent.

47. (Withdrawn) A process in accordance with claim 34 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

48. (Withdrawn) A process in accordance with claim 34 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

49. (Withdrawn) A process in accordance with claim 34 wherein said promoter is present in an amount in the range of from 8 to 20 weight percent.

50. (Withdrawn) A process in accordance with claim 34 wherein said silicon-containing material is present in an amount in the range of from about 10 to about 40 weight percent and said alumina is present in an amount in the range of from about 1 to about 30 weight percent.

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51. (Withdrawn) A process in accordance with claim 34 wherein said silicon-containing material is present in an amount in the range of from about 12 to about 30 weight percent and said alumina is present in an amount in the range of from about 5 to about 25 weight percent.

52. (Withdrawn) A process in accordance with claim 34 wherein said silicon-containing material is present in an amount in the range of from 13 to 20 weight percent and said alumina is present in an amount in the range of from 10 to 20 weight percent.

53. (Withdrawn) A process in accordance with claim 34 wherein said promoter is comprised of nickel.

54. (Withdrawn) A process in accordance with claim 34 wherein said promoter is comprised of cobalt.

55. (Withdrawn) A process in accordance with claim 34 wherein said promoter is comprised of a solid solution of nickel and zinc.

56. (Withdrawn) A process in accordance with claim 34 wherein said calcined mixture is reduced in step (d) at a temperature in the range of from about 100°F to about 1500°F and at a pressure in the range of from about 15 to about 1500 psia and for a time sufficient to permit the formation of a reduced valence promoter.

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57. (Withdrawn) A process in accordance with claim 34 wherein said dried mixture is calcined in step (c) to convert at least a portion of said alumina to aluminate.

58. (Previously Presented) A composition prepared by a process comprising:

(a) admixing: 1) a liquid, 2) manganese oxide, 3) a silicon-containing material, 4) alumina, and 5) a promoter so as to form a mixture thereof;

(b) drying said mixture so as to form a dried mixture;

(c) calcining said dried mixture so as to form a calcined mixture;

(d) reducing said calcined mixture with a suitable reducing agent under suitable conditions to produce a composition having a promoter wherein at least a portion of said promoter is present as a zero valence promoter, and

(e) recovering said composition.

59. (Previously Presented) A composition in accordance with claim 58 wherein said mixture from step (a) is particulated prior to said drying in step (b).

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60. (Previously Presented) A composition in accordance with claim 58 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

61. (Previously Presented) A composition in accordance with claim 58 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

62. (Previously Presented) A composition in accordance with claim 58 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

63. (Previously Presented) A composition in accordance with claim 58 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

64. (Previously Presented) A composition in accordance with claim 58 wherein said silicon-containing material is present in an amount in the range of from about 10 to about 40 weight percent and said alumina is present in an amount in the range of from about 1 to about 30 weight percent.

65. (Withdrawn) A process for the production of a composition comprising:

(a) admixing: 1) a liquid, 2) manganese oxide, 3) a silicon-containing material, and 4) alumina so as to form a mixture thereof;

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- (b) drying said mixture so as to form a dried mixture;
- (c) calcining said dried mixture so as to form a calcined mixture;
- (d) incorporating a promoter onto or into said calcined mixture so as to form a promoted mixture;
- (e) drying said promoted mixture so as to form a dried promoted mixture;
- (f) calcining said dried promoted mixture so as to form a calcined promoted mixture;
- (g) reducing said calcined promoted mixture with a suitable reducing agent under suitable conditions to produce a composition having a reduced valence promoter content therein; and
- (h) recovering said composition.

66. (Withdrawn) A process in accordance with claim 65 wherein said calcined promoted mixture is reduced in step (g) such that said composition of step (g) will effect the removal of sulfur from a stream of hydrocarbons when such stream is contacted with same under desulfurization conditions.

67. (Withdrawn) A process in accordance with claim 65 wherein said calcined mixture from step (c) is incorporated with a promoter

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comprised of at least one metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, and combinations of any two or more thereof.

68. (Withdrawn) A process in accordance with claim 65 wherein said silicon-containing material is present in the form of expanded perlite.

69. (Withdrawn) A process in accordance with claim 65 wherein said mixture from step (a) is in the form of one of a wet mix, dough, paste, or slurry.

70. (Withdrawn) A process in accordance with claim 65 wherein said mixture from step (a) is particulated prior to drying in step (b).

71. (Withdrawn) A process in accordance with claim 65 wherein said mixture from step (a) is particulated in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres.

72. (Withdrawn) A process in accordance with claim 65 wherein said mixture from step (a) is particulated by spray drying in step (b) so as to form said dried mixture.

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73. (Withdrawn) A process in accordance with claim 65 wherein said mixture and said promoted mixture are dried in steps (b) and (e), respectively, at a temperature in the range of about 150°F to about 450°F.

74. (Withdrawn) A process in accordance with claim 65 wherein said dried mixture and said dried promoted mixture are calcined in steps (c) and (f), respectively, at a temperature in the range of about 400 to about 1500°F.

75. (Withdrawn) A process in accordance with claim 65 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

76. (Withdrawn) A process in accordance with claim 65 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

77. (Withdrawn) A process in accordance with claim 65 wherein said manganese oxide is present in an amount in the range of from about 50 to about 70 weight percent.

78. (Withdrawn) A process in accordance with claim 65 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

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79. (Withdrawn) A process in accordance with claim 65 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

80. (Withdrawn) A process in accordance with claim 65 wherein said promoter is present in an amount in the range of from 8 to 20 weight percent.

81. (Withdrawn) A process in accordance with claim 65 wherein said silicon-containing material is present in an amount in the range of from about 10 to about 40 weight percent and said alumina is present in an amount in the range of from about 1.0 to about 30 weight percent.

82. (Withdrawn) A process in accordance with claim 65 wherein said silicon-containing material is present in an amount in the range of from about 12 to about 30 weight percent and said alumina is present in an amount in the range of from about 5 to about 25 weight percent.

83. (Withdrawn) A process in accordance with claim 65 wherein said silicon-containing material is present in an amount in the range of from 13 to 20 weight percent and said alumina is present in an amount in the range of from 10 to 20 weight percent.

84. (Withdrawn) A process in accordance with claim 65 wherein said promoter is comprised of nickel.

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85. (Withdrawn) A process in accordance with claim 65 wherein said promoter is comprised of cobalt.

86. (Withdrawn) A process in accordance with claim 65 wherein said promoter is comprised of a solid solution of nickel and zinc.

87. (Withdrawn) A process in accordance with claim 65 wherein the reduction of said calcined promoted mixture in step (g) is carried out at a temperature in the range of from about 100°F to about 1500°F and at a pressure in the range of from about 15 to about 1500 psia and for a time sufficient to permit the formation of a reduced valence promoter.

88. (Withdrawn) A process in accordance with claim 65 wherein said dried mixture from step (b) is calcined in step (c) to convert at least a portion of said alumina to aluminate.

89. (Previously Presented) A composition prepared by the process of:

(a) admixing: 1) a liquid, 2) manganese oxide, 3) a silicon-containing material, and 4) alumina so as to form a mixture thereof;

(b) drying said mixture so as to form a dried mixture;

(c) calcining said dried mixture so as to form a calcined mixture;

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(d) incorporating a promoter onto or into said calcined mixture so as to form a promoted mixture;

(e) drying said promoted mixture so as to form a dried promoted mixture;

(f) calcining said dried promoted mixture so as to form a calcined promoted mixture;

(g) reducing said calcined promoted mixture with a suitable reducing agent under suitable conditions to produce a composition having a promoter wherein at least a portion of said promoter is present as a reduced valence promoter; and

(h) recovering said composition.

90. (Previously Presented) A composition in accordance with claim 89 wherein said mixture from step (a) is particulated prior to drying in step (b).

91. (Previously Presented) A composition in accordance with claim 89 wherein said manganese oxide is present in an amount in the range of from about 10 to about 90 weight percent.

92. (Previously Presented) A composition in accordance with claim 89 wherein said manganese oxide is present in an amount in the range of from about 40 to about 80 weight percent.

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93. (Previously Presented) A composition in accordance with claim 89 wherein said promoter is present in an amount in the range of from about 1 to about 60 weight percent.

94. (Previously Presented) A composition in accordance with claim 89 wherein said promoter is present in an amount in the range of from about 5 to about 40 weight percent.

95. (Previously Presented) A composition in accordance with claim 89 wherein said silicon-containing material is present in an amount in the range of from about 10 to about 40 weight percent and said alumina is present in an amount in the range of from about 1.0 to about 30 weight percent.

96. (Withdrawn) A process for the removal of sulfur from a hydrocarbon stream comprising:

(a) contacting said hydrocarbon stream with a composition comprising manganese oxide and a promoter wherein at least a portion of said promoter is present as a reduced valence promoter and in an amount which will effect the removal of sulfur from said hydrocarbon stream in a desulfurization zone under conditions such that there is formed a desulfurized hydrocarbon stream and a sulfurized composition;

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(b) separating said desulfurized hydrocarbon stream from said sulfurized composition thereby forming a separated desulfurized hydrocarbon stream and a separated sulfurized composition;

(c) regenerating at least a portion of said separated sulfurized composition in a regeneration zone so as to remove at least a portion of the sulfur contained therein and/or thereon thereby forming a regenerated composition;

(d) reducing said regenerated composition in an activation zone so as to provide a reduced composition having a reduced valence promoter content therein which will effect the removal of sulfur from a hydrocarbon stream when contacted with same; and thereafter

(e) returning at least a portion of said reduced composition to said desulfurization zone.

97. (Withdrawn) A process in accordance with claim 96 wherein said hydrocarbon stream comprises a fuel selected from the group consisting of cracked-gasoline, diesel fuel, and combinations thereof.

98. (Withdrawn) A process in accordance with claim 96 wherein said desulfurization in step (a) is carried out at a temperature in the range of from about 100°F to about 1000°F and a pressure in the range of from

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about 15 to about 1500 psia for a time sufficient to effect the removal of sulfur from said stream.

99. (Withdrawn) A process in accordance with claim 96 wherein said regeneration in step (c) is carried out at a temperature in the range of from about 100°F to about 1500°F and a pressure in the range of from about 10 to about 1500 psia for a time sufficient to effect the removal of at least a portion of the sulfur from said separated sulfurized composition.

100. (Withdrawn) A process in accordance with claim 96 wherein there is employed air in step (c) as a regeneration agent in said regeneration zone.

101. (Withdrawn) A process in accordance with claim 96 wherein said regenerated composition from step (c) is subjected to reduction with hydrogen in step (d) in a hydrogenation zone which is maintained at a temperature in the range of from about 100°F to about 1500°F and at a pressure in the range of from about 15 to about 1500 psia and for a period of time sufficient to effect a reduction of the valence of the promoter content of said regenerated composition.

102. (Withdrawn) A process in accordance with claim 96 wherein said separated sulfurized composition from step (b) is stripped prior to introduction into said regeneration zone in step (c).

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103. (Withdrawn) A process in accordance with claim 96 wherein said regenerated composition from step (c) is stripped prior to introduction to said activation zone in step (d).

104. (Withdrawn) The cracked-gasoline product of the process of claim 96.

105. (Withdrawn) The diesel fuel product of the process of claim 96.

106. (Withdrawn) A process for the removal of sulfur from a hydrocarbon stream comprising:

(a) contacting said hydrocarbon stream with a composition comprising manganese oxide, a silicon-containing material, an aluminum-containing material selected from the group consisting of alumina, aluminate, and combinations thereof, and a promoter wherein at least a portion of said promoter is present as a reduced valence promoter and in an amount which will effect the removal of sulfur from said hydrocarbon stream in a desulfurization zone under conditions such that there is formed a desulfurized hydrocarbon stream and a sulfurized composition;

(b) separating said desulfurized hydrocarbon stream from said sulfurized composition thereby forming a separated desulfurized hydrocarbon stream and a separated sulfurized composition;

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(c) regenerating at least a portion of said separated sulfurized composition in a regeneration zone so as to remove at least a portion of the sulfur contained therein and/or thereon thereby forming a regenerated composition;

(d) reducing said regenerated composition in an activation zone so as to provide a reduced composition having a reduced valence promoter content therein which will effect the removal of sulfur from a hydrocarbon stream when contacted with same; and thereafter

(e) returning at least a portion of said reduced composition to said desulfurization zone.

107. (Withdrawn) A process in accordance with claim 106 wherein said hydrocarbon stream comprises a fuel selected from the group consisting of cracked-gasoline, diesel fuel, and combinations thereof.

108. (Withdrawn) A process in accordance with claim 106 wherein said desulfurization in step (a) is carried out at a temperature in the range of from about 100°F to about 1000°F and a pressure in the range of from about 15 to about 1500 psia for a time sufficient to effect the removal of sulfur from said stream.

109. (Withdrawn) A process in accordance with claim 106 wherein said regeneration in step (c) is carried out at a temperature in the range

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of from about 100°F to about 1500°F and a pressure in the range of from about 10 to about 1500 psia for a time sufficient to effect the removal of at least a portion of the sulfur from said separated sulfurized composition.

110. (Withdrawn) A process in accordance with claim 106 wherein there is employed air in step (c) as a regeneration agent in said regeneration zone.

111. (Withdrawn) A process in accordance with claim 106 wherein said regenerated composition from step (c) is subjected to reduction with hydrogen in step (d) in a hydrogenation zone which is maintained at a temperature in the range of from about 100°F to about 1500°F and at a pressure in the range of from about 15 to about 1500 psia and for a period of time sufficient to effect a reduction of the valence of the promoter content of said regenerated composition.

112. (Withdrawn) A process in accordance with claim 106 wherein said separated sulfurized composition from step (b) is stripped prior to introduction into said regeneration zone in step (c).

113. (Withdrawn) A process in accordance with claim 106 wherein said regenerated composition from step (c) is stripped prior to introduction to said activation zone in step (d).

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114. (Withdrawn) The cracked-gasoline product of the process of claim 106.

115. (Withdrawn) The diesel fuel product of the process of claim 106.

116. (New) A composition in accordance with claim 1 wherein said suitable conditions comprise a temperature in the range of from about 100 F to about 1500 F and at a pressure in the range of from about 15 to 1500 psia for a time sufficient to permit the formation of a zero valence promoter.

117. (New) A composition in accordance with claim 15 wherein said suitable conditions comprise a temperature in the range of from about 100°F to about 1500°F and at a pressure in the range of from about 15 to 1500 psia for a time sufficient to permit the formation of a zero valence promoter.

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